

REMARKS

Entry of the foregoing, re-examination and reconsideration of the application identified in caption, as amended, pursuant to and consistent with 37 C.F.R. §1.112 and in light of the remarks which follow are respectfully requested.

As correctly indicated in the Office Action summary, Claims 1-42 are pending. The Office Action Summary further indicates that Claims 1-42 are rejected.

By the present amendment, Claims 6, 10, 11, 18, 19 and 28 have been canceled. Claims 1-5, 7, 8, 9, 12-17, 20-27 and 29-42 are currently pending in this application with the entry of this Amendment. By the present amendment, the three independent claims, *i.e.* Claims 1, 9 and 17, have been amended to recite that the catalyst does not contain chromium as a catalyst component, and also to recite specific ratios of steam to raw material feed amounts. Support for this amendment can be found at least in the specification as-filed at page 28, lines 1 and 2 and page 11, lines 8-12. Dependent Claims 4, 16, 25, 26, 35, and 42 have all been amended to clarify that the catalyst may further comprise additional components, in response to the rejection under 35 U.S.C. §112. Support for these amendments can be found at least in the specification as-filed at page 8, lines 3-12. The abstract has also been amended in response to the objection to its form. Support for the abstract can be found at least in the original Abstract as-filed. Thus, no new matter has been added by this amendment.

The above amendments have been presented solely for the purpose of expediting what appears to be allowable subject matter. Applicants reserve the right to file a continuation application directed to the originally presented claims.

Upon review of the Official Action, it is noted that the Examiner has not acknowledged a claim of foreign priority, and has not acknowledged receipt of the copies of the certified copies of the priority documents in this National Stage application from the International Bureau pursuant to PCT Rule 17.2(a). It is respectfully requested that the Examiner please confirm whether such copies have been received, and if appropriate, acknowledge receipt of the certified copies of the priority documents from the International Bureau in this National stage application in his next communication.

Secondly, it is noted that the PTO Form 1449, from the Information Disclosure Statement submitted on February 28, 2002, has been returned without any initials next to the following references: EP 0,177,832; JP 05-246908 (with abstract); WO 99/03806 and WO 91/06366. It is respectfully requested that the Examiner initial next to each of the references if they were considered. Applicants respectfully request that the Examiner-initialed form please be included in the Examiner's next communication.

I. THE OBJECTION TO THE ABSTRACT

The Office Action indicated that the Abstract was not in compliance with MPEP § 608.01(b), because it was not in the form of a single paragraph. Applicants submit that the objection has been obviated by the current amendment to the Abstract, where the

Abstract is now presented as a single paragraph. Respectfully, Applicants request that this objection be removed.

II. THE REJECTION OF CLAIMS 4, 11, 16, 19, 25, 26 AND 42 UNDER 35 U.S.C. §1.112, second paragraph

Claims 4, 11, 16, 19, 25, 26 and 42 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Respectfully, Applicants traverse this rejection.

The Office Action stated that Claims 4, 16, 25, 26, 35 and 42 were unclear with respect to what the difference was between the potassium in the independent claims and the alkali metal compounds in Claims 4, 16, 25 and 26. The Office Action stated that this makes the dependent claims inconsistent with the independent claims.

By the present amendment, dependent Claims 4, 16, 25, 26, 35 and 42 have been amended to recite that the solid catalyst "further comprises..." and that the further alkali metal compound is "other than the potassium compound" or that the alkaline metal compound is "other than the magnesium compound" that is already specified in the claims from which they depend. These amendments should make it clear that dependent claims further comprise additional components. Accordingly, Applicants submit that these rejections have been obviated by the present amendments.

The Office Action also stated that Claims 11 and 19 were inconsistent with Claims 9 and 17, since Claims 9 and 17 positively require steam as regenerating agent, the two

is now presented as a single paragraph. Respectfully, Applicants request that this objection be removed.

II. THE REJECTION OF CLAIMS 4, 11, 16, 19, 25, 26 AND 42 UNDER 35 U.S.C. §1.112, second paragraph

Claims 4, 11, 16, 19, 25, 26 and 42 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Respectfully, Applicants traverse this rejection.

The Office Action stated that Claims 4, 16, 25, 26, 35 and 42 were unclear with respect to what the difference was between the potassium in the independent claims and the alkali metal compounds in Claims 4, 16, 25 and 26. The Office Action stated that this makes the dependent claims inconsistent with the independent claims.

By the present amendment, dependent Claims 4, 16, 25, 26, 35 and 42 have been amended to recite that the solid catalyst "further comprises..." and that the further alkali metal compound is "other than the potassium compound" or that the alkaline metal compound is "other than the magnesium compound" that is already specified in the claims from which they depend. These amendments should make it clear that dependent claims further comprise additional components. Accordingly, Applicants submit that these rejections have been obviated by the present amendments.

The Office Action also stated that Claims 11 and 19 were inconsistent with Claims 9 and 17, since Claims 9 and 17 positively require steam as regenerating agent, the two

dependent claims do not require steam, but instead replace steam with oxygen or air.

Claims 9 and 17 have been amended to recite "steam, oxygen or air" to make it clear that steam, oxygen or air may be used. Claims 11 and 19 have been canceled in the present amendment. Therefore, while not necessarily agreeing with the rejection, Applicants respectfully submit that this rejection has been obviated by the present amendment.

Therefore, Applicants respectfully request withdrawal of this rejection.

III. THE REJECTION OF CLAIMS 1, 2, 4-13, 15-21, 23-32, 35-37 AND 40-42, AS WELL AS CLAIMS 3, 14, 22, 33, 34, 38 AND 39 UNDER 35 U.S.C. §103(a)

Claims 1, 2, 4-13, 15-21, 23-32, 35-37 and 40-42 stand rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 3,429,941 (hereinafter "*Kerr et al.*"). Claims 3, 14, 22, 33, 34, 38 and 39 stand rejected under 35 U.S.C. §103(a) as being obvious over *Kerr et al.* in view of U.S. Patent No. 3,907,916 (hereinafter "*Soderquist et al.*"). Respectfully, Applicants traverse these rejections.

The present invention relates to a method of dehydrogenating triisopropyl benzene or diisopropyl benzene in a vapor phase at an elevated temperature in the presence of steam and a solid catalyst to produce diisopropyl isopropenyl benzene, isopropyl diisopropenyl benzene and/or triisopropenyl benzene. The solid catalyst is mainly composed of an iron compound and a potassium compound and does not contain chromium as a catalyst component. The feed amount of the steam which is fed together with the raw material triisopropyl benzene is between 10 and 60 times in weight ratio as large as the feed amount

of the triisopropyl benzene or between 3 and 60 times in weight ratio as large as the feed amount of diisopropyl benzene, respectively. (*See, e.g.*, Independent Claims 1, 9 and 17.)

In stark contrast to the prior art, and as explained in the specification and exemplified by the Examples, the catalysts and processes according to the invention provide an economical and industrial method for the dehydrogenation of triisopropyl benzene (hereinafter "TIPB") and diisopropyl benzene (hereinafter "DIPB"). Moreover, a continuous and stable operating method is provided, in which an environmentally-friendly catalyst that does not contain chromium is employed, and the deterioration of the catalyst is avoided. *See* paragraph bridging pages 3-4.

Based on a complete understanding of the present invention as claimed, it is respectfully submitted that the claims cannot properly be rejected based on the documents as applied in the Official Action.

Kerr et al. was asserted in the Office Action as disclosing a process of dehydrogenating a pulsed feed of polyisopropylbenzene including the tri-isopropylbenzene and diisopropylbenzene to produce corresponding aro-olefins in the presence of a catalyst containing iron and potassium compounds in the presence of a continuously-fed stream so that the process is divided into two different periods--reaction and regeneration. The Office Action stated that it appeared that *Kerr et al.* was silent with respect to the phase of the hydrocarbon feed, but asserts that it would have been obvious to modify the process of *Kerr et al.* by employing a gas phase hydrocarbon for reaction conditions since it is expected that gas or liquid phase would yield similar results. The Office Action pointed to

column 3, lines 48-52 for the temperature of the process, which is said to be 800 to 1200°F.

The Office Action acknowledged that *Kerr et al.* did not disclose specific LHSV of the hydrocarbon, but asserted that the LHSV was a known parameter of chemical reactions. The Office Action stated that it would have been obvious to modify the *Kerr et al.* process by selecting appropriate LHSV of the feed to optimize the process. Alternatively, the Office Action stated that it would have been obvious to operate the *Kerr et al.* process at the applicant's claimed LHSV since it would be expected that running the *Kerr et al.* process at any LHSV would yield similar results.

The Office Action conceded that *Kerr et al.* was silent with respect to using oxygen or air to regenerate the coked catalyst, but asserted that coke deposited on the *Kerr et al.* catalyst is carbon, and that it would have been obvious to use oxygen or air to burn off the coke on the catalyst since coke made the Kerr catalyst deactivated. (See column 2, lines 9-13.)

Finally, the Office Action recognized that *Kerr et al.* did not disclose a catalyst containing magnesium. In order to remedy this deficiency, the Office Action turned to *Soderquist et al.* for disclosure of a dehydrogenation catalyst containing magnesium. (See abstract and column 1, line 39.) The Office Action asserted that it would have been obvious to modify the *Kerr et al.* process by adding magnesium since *Soderquist et al.* disclosed that a dehydrogenation catalyst should have magnesium.

Initially, a proper analysis of the obviousness/nonobviousness of the claimed invention by the USPTO requires consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should practice the claimed invention; and (2) whether the prior art would also have revealed that in so practicing, there would be a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the Applicant's disclosure. *In re Sernaker*, 217 U.S.P.Q. 1, at 5 (Fed. Cir. 1983); and *In re Vaeck*, 20 USPQ2d 1438, 1442 (CAFC 1991).

When so analyzed, it is clear that this rejection is in error because *Kerr et al.* and *Soderquist et al.* do not disclose or fairly suggest the claimed invention.

Neither of *Kerr et al.* nor *Soderquist et al.* disclose or fairly suggest that the catalyst used should be free of chromium. Much to the contrary, both *Kerr et al.* and *Soderquist et al.* disclose catalysts that all contain chromium.

As explained in the specification, at the paragraph bridging pages 2-3:

Catalysts thus far known cannot be yet satisfactory for industrial operation due to problems of the activity and catalyst life, and additionally have problems of requiring enormous costs of disposition as spent catalysts in view of environmental matter, since all the catalysts except for melt lithium or lead iodide catalysts contain chromium. Therefore, it is difficult to say that these catalysts are good industrial catalysts. Furthermore, in the case where melt lithium or lead iodide catalysts are employed, there are problems in methods of handling the catalysts in a melting state.

In contrast to the prior art, the claimed invention employs a catalyst that does not contain chromium. Thus, the claimed invention advantageously provides an economical

method for the dehydrogenation of TIPB and/or DIPB in which an environmentally-friendly catalyst that does not contain chromium is used.

The Examples demonstrate that using the catalysts and processes according to the invention, it is possible to obtain diisopropyl isopropenyl benzene (hereinafter "DIIPeB"), isopropyl diisopropenyl benzene (hereinafter "IPDIPeB") and/or triisopropenyl benzene (hereinafter "TIPeB") in a high yield and at a high selectivity. *See* Examples 1-4 and Comparative Examples 1-2. For the Examiner's convenience, the results of these experiments are summarized in the table below:

Example	Catalyst Components	Conversion Ratio of 1,3,5-TIPB (%)	1,3-DIP-5-IPeB (%)	1-IP-3,5-DIPeB (%)	1,3,5-TIPeB (%)
1	Fe, K, Mg, Ce, Mo, Ca	90	12	23	54
2	Fe, K, Mg, others	99	1	11	80
3	Fe, K, Mg, others	99	1	10	82
4	Fe, K, Mg, Ce, Mo	88	16	28	40
Comparative Examples					
1	Cr, Mg, Al	25	14	8	1
2	Cu, Cr	23	13	6	0

Thus, as demonstrated by Examples 1-4 and Comparative Examples 1 and 2, it is clear that an improved conversion ratio of 1,2,4-TIPB is achieved, as well as improved selectivity.

Moreover, there is nothing that would have motivated one of ordinary skill in the art to exclude chromium, especially since every catalyst disclosed in *Kerr et al.* and *Soderquist et al.* comprises chromium.

Finally, there is nothing in either of the cited documents that would have led one of ordinary skill in the art to believe that there would have been a reasonable expectation of success in doing so. There is absolutely nothing in either of *Kerr et al.* or *Soderquist et al.* to suggest that DIPB or TIPB could be converted to obtain DIPIEB, IPDIPEB and/or TIPEB in improved yield and selectivity.

In addition to using a catalyst substantially free from chromium, the claimed invention uses a specific amount of steam with respect to the raw starting materials. As recited in the claims, the feed amount of the steam to raw material TIPB is 10 to 60 times in weight ratio, and the feed amount of steam to raw material DIPB is 3 to 60 times in weight ratio. (*See, e.g.*, claims 1, 9 and 17.)

Controlling the feed amount of steam relative to the raw material can lead to improved yields, as demonstrated by a comparison of Examples 9 and 10. In Example 9, the feed ratio of steam to 1,3,5-TIPB (wt/wt) was 10, 20, 40 and 60 respectively. The results are shown in Table 3 on page 21 of the specification. In contrast, in Example 10, the feed ratio of steam to 1,3,5-TIPB (wt/wt) was 2. The conversion ratio dropped to 30% and the product yield was 13% 1,3-DIP-5-IPeB, 12% 1-IP-3,5-DIPeB and 0% 1,3,5-TIPeB.

There is nothing in either of the cited documents that teaches or suggests that the feed ratio or steam to raw materials should be maintained within the recited ranges, much less that there would be a reasonable expectation of success in doing so. Neither *Kerr et al.* nor *Soderquist et al.* teach or suggest that there would be a reasonable expectation of success in improving the yield and selectivity in the dehydrogenation of TIPB or DIPB by maintaining the feed ratio of steam to raw materials within the specific ranges.

The Federal Circuit has repeatedly stated that the motivation and the reasonable expectation of success must come from the prior art, not Applicant's specification. *See In re Dow Chem. Co. v American Cyanamid Co.*, 837 F.2d at 473, 5 U.S.P.Q.2d at 1531-1532 ("[t]here must be a reason or suggestion in the art for selecting the procedure used, other than the knowledge learned from the applicant's disclosure"). Using an Applicant's disclosure as a blueprint to reconstruct the claimed invention from isolated pieces of the prior art contravenes the statutory mandate of §103 of judging obviousness at the point in time when the invention was made. *See Grain Processing Corp. v. American Maize-Prods. Co.*, 840 F.2d 902, 907, 5 U.S.P.Q.2d 1788, 1792 (Fed. Cir. 1988).

Thus, even if the documents would have been combined in the manner suggested by the Official Action, the present invention would not result. In this regard, there is nothing in *Kerr et al.* by itself or in combination with *Soderquist et al.* that discloses or suggests the claimed invention. Accordingly, Applicants respectfully submit that no *prima facie* case of obviousness has been established. Thus, Applicants respectfully request that this ground for rejection be withdrawn.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order, and such action is earnestly solicited.

If there are any questions concerning this paper or the application in general, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: *G. Whitney Hapangama*
G. Whitney Hapangama
Limited Recognition Under 37 C.F.R. §10.9(b)
(See Attached Document)

P.O. Box 1404
Alexandria, VA 22313-1404
(703) 836-6620

Date: October 15, 2003